NISTTech

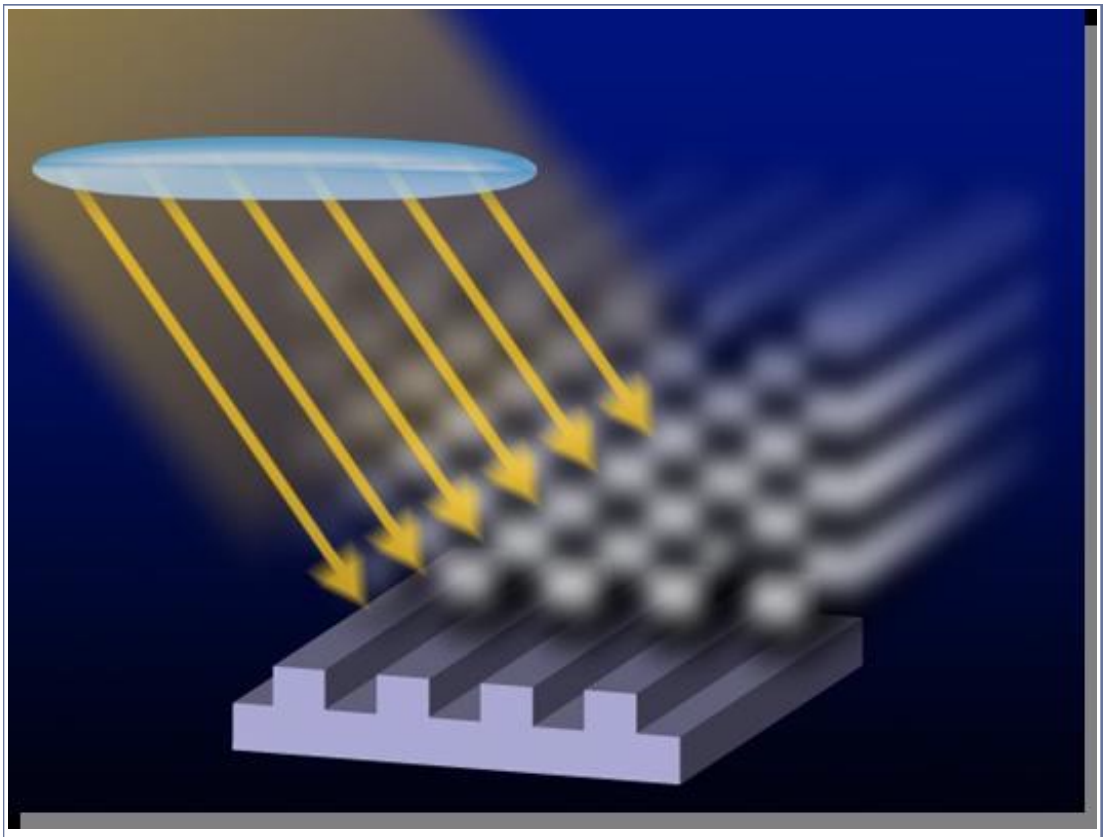
Zeroeth Order Imaging

Optical Metrology for Manufacturing

Description

Low cost high throughput optical metrology technique with applications in process control and metrology for semiconductor manufacturing, and emerging nanotechnology industries. The invention provides a method to measure densely positioned features with nanometer scale accuracy and works by imaging the zeroeth order of diffracted light. The targets present no limit to the size or density of the features to be imaged. That is, features as small as 20 nm in size with a pitch or spacing of 50 nm can be imaged.

Images



Measuring 10 nm or 20 nm sized features with 450 nm wavelength light. Well beyond conventional resolution limits using engineered illumination and structured targets. Credit: NIST

Applications

- **Semiconductor manufacturing**

Critical Dimension (CD) metrology; Overlay metrology; Defect inspection.

- **Nanomanufacturing applications**
  Fuel cell process control; Arrayed nanoparticles; Nanometer sensitivity

Advantages

- **Greater resolution, more dense components**
  May image features as small as 20 nm in size with a pitch or spacing of 50 nm.
- **Scatterometry type measurements on very small targets.**
  Low cost, parallel measurements of multiple targets, small scribe line target size.
- **Repeatability**
  Excellent sensitivity and repeatability.

Abstract

A method of imaging critical dimensions by measuring the zeroeth order of diffracted light. The method involves providing a target, directing light onto the target so as to cause the target to diffract the light. The zeroeth order of the diffracted light is collected and analyzed to determine structural features of the target. The target can be an article of manufacture, such as a semiconductor device, or a separate target that is provided or fabricated on an article of manufacture. One of at least the wavelength and the angle at which the light is directed onto the target can be scanned. The target can fill all or only a portion of the field of view.

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Citations

1. R.M. Silver,B.M. Barnes, R. Attota, J. Jun, M. Stocker, E. Marx, and H.J. Patrick. Scatterfield microscopy for extending the limits of image-based optical metrology. Applied Optics, Vol 46, No. 20, July 2007.

References

- U.S. Patent # 7,812,943

- Docket: 06-003

Status of Availability

This invention is available for licensing.

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